Proposed general budget for USGS groundwater monitoring component to support of WCCD ARM study.

The goal of the groundwater element is to provide a supporting line of evidence of comparison of the effectiveness of manure management strategies at controlling offsite migration of manure management strategies. This element focuses primarily on monitoring the changing concentrations of nitrogen, phosphorus, and fecal bacteria in groundwater at the water table beneath study plots throughout the agricultural and dormant season. This approach to monitoring will necessitate a flexible sample collection approach able to isolate the uppermost 10-15 cm of the groundwater system near the water table in a ground water system in which seasonal fluctuation of the water table can be as much as 15 feet. Additional complicating requirement will be the collection of multiple samples (2-4 per field plot) sufficient to assess near scale variation in water quality concentrations resulting from hydrogeologic heterogeneity so that differences measured beneath farm plots of contrasting manure management can be related primarily to differences in manure management strategy.

Monitoring strategy will employ a combined approach utilizing passive diffusion samplers and moveable isolation packer within the 20 to 30 foot fixed screened interval that encompasses the seasonal variation in the local ground water level. Continuous water level monitors will be deployed at each study site to monitor the local piezometric surface at each site. Repetitive water quality monitoring will be scheduled approximated 24 times per year in conjunction with seasonal climatological, manure, and irrigation practices which will be monitored by the WCCD using onsite meteological station. Sampling intensity will be increased at times of manure application and potential recharge events. Measurements of water quality constituents will utilize a combination of field screening and standard laboratory techniques. Field techniques will utilize both direct reading water quality probe instruments and field spectorphotometric measurement techniques appropriate for limited water quality sample volume that may be available. Sampling protocol using adjustable packer/isolator system will be tested on existing monitoring wells to determine well yield characteristics, capability to isolate groundwater at the water table, and sample collection procedures. Passive diffusion sample collection may be utilized if monitoring wells fail to yield sufficient groundwater for pumped water sample collection. Passive diffusion samples may also be used to provide vertical profile of groundwater quality beneath the water table zone if this information is needed to compare ARM strategies.

Following agreement to conduct this investigation a detailed Quality Assurance Project Plan will be written and reviewed. The QAPP will describe integration of this groundwater element into the overall WCCD ARM study and will describe in detail monitoring and sampling design, sampling frequency and methods, water-quality analytical procedures, and data analysis approach. Mid way through project the collected data will be assess to see if there is sufficient data available to model vadose zone transport of nutrients and options discussed with WCCD. During the fourth year of the project a brief journal article or USGS report will be prepared.